

AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (Currently amended) A plasma processing system comprising:
 - a plasma processing chamber;
 - a vacuum pump connected to the processing chamber;
 - a substrate support on which a substrate is processed within the processing chamber;
 - a dielectric member having an interior surface facing the substrate support, wherein the dielectric member forms a wall of the processing chamber;
 - a gas injector extending through the dielectric member, the gas injector comprising a body including an axial end surface exposed within the processing chamber, a side surface extending axially from the axial end surface, and a plurality of gas outlets including at least one on-axis outlet in the axial end surface and a plurality of spaced-apart off-axis outlets in the side surface ~~such that a distal end of the gas injector is exposed within the processing chamber, the gas injector including a plurality of gas outlets supplying process gas at flow rates that are independently varied between at least some of the outlets into the processing chamber, the gas outlets being supplied process gas by a single gas supply; and~~
 - a common gas supply in fluid communication with a first gas line and a second gas line, the first gas line being in fluid communication with the on-axis outlet but not with the off-axis outlets and the second gas line being in fluid communication with the off-axis outlets but not with the on-axis outlet;
 - flow controllers operable to supply process gas from the common gas supply at flow rates that are independently varied between the on-axis outlet and the off-axis outlets into the processing chamber; and

an RF energy source which inductively couples RF energy through the dielectric member and into the chamber to energize the process gas into a plasma state to process the substrate.

2. (Original) The system of Claim 1, wherein the system is a high density plasma chemical vapor deposition system or a high density plasma etching system.

3. (Original) The system of Claim 1, wherein the RF energy source comprises an RF antenna and the gas injector injects the process gas toward a primary plasma generation zone in the chamber.

4. (Currently amended) The system of Claim 1, wherein ~~the gas outlets include a single on-axis outlet in an the axial end surface of the gas injector and a plurality of off-axis outlets in a the side surface of the gas injector, the on-axis outlet and the off-axis outlets being supplied process gas from the single gas supply via first and second gas lines, the gas lines including flow controllers which provide adjustable gas flow to the on-axis outlet independently of the off-axis outlets~~ the first gas line is in fluid communication with an axially extending central bore in the injector body, and the second gas line is in fluid communication with an annular gas passage surrounding the central bore.

5. (Currently amended) The system of Claim 1, wherein ~~the gas outlets include a center on-axis gas outlet extending in an axial direction perpendicular to the an exposed surface of the substrate and a plurality of angled off-axis gas outlets extending at an acute angle to the axial direction, the center on-axis gas outlet receiving process gas supplied by a the first gas line and the angled off-axis gas outlets receiving process gas from a the second gas line, the first and second gas lines receiving process gas from the single common gas~~

supply the injector body is cylindrical shaped and the off-axis outlets are circumferentially spaced apart.

6. (Original) The system of Claim 1, wherein the gas injector injects the process gas at a subsonic, sonic, or supersonic velocity.

7. (Previously presented) A plasma processing system comprising:

- a plasma processing chamber;
- a vacuum pump connected to the processing chamber;
- a substrate support on which a substrate is processed within the processing chamber;
- a dielectric member having an interior surface facing the substrate support, wherein the dielectric member forms a wall of the processing chamber;
- a gas injector extending through the dielectric member such that a distal end of the gas injector is exposed within the processing chamber, the gas injector including a planar axial end face having an on-axis outlet therein and a conical side surface having off-axis outlets therein, the on-axis outlet receiving process gas from a central passage in the injector and the off-axis outlets receiving process gas from an annular passage surrounding the central passage, the gas injector supplying process gas at flow rates that are independently varied between at least some of the outlets including the on-axis outlet into the processing chamber; and
- an RF energy source which inductively couples RF energy through the dielectric member and into the chamber to energize the process gas into a plasma state to process the substrate.

8. (Original) The system of Claim 1, wherein the gas injector is removably mounted in the dielectric window and supplies the process gas into a central region of the chamber.

9. (Previously presented) A plasma processing system comprising:

- a plasma processing chamber;
- a vacuum pump connected to the processing chamber;
- a substrate support on which a substrate is processed within the processing chamber;
- a dielectric member having an interior surface facing the substrate support, wherein the dielectric member forms a wall of the processing chamber;
- a gas injector extending through the dielectric member such that a distal end of the gas injector is exposed within the processing chamber, the gas injector including at least one on-axis outlet which injects process gas in an axial direction perpendicular to a plane parallel to an exposed surface of the substrate and off-axis gas outlets which inject process gas at an acute angle relative to the plane parallel to the exposed surface of the substrate, the gas injector supplying process gas at flow rates that are independently varied between at least some of the outlets into the processing chamber; and
- an RF energy source which inductively couples RF energy through the dielectric member and into the chamber to energize the process gas into a plasma state to process the substrate.

10. (Currently amended) A plasma processing system comprising:

- a plasma processing chamber;
- a vacuum pump connected to the processing chamber;
- a substrate support on which a substrate is processed within the processing chamber;
- a dielectric member having an interior surface facing the substrate support, wherein the dielectric member forms a wall of the processing chamber;

a gas injector removably mounted in an opening in the dielectric member and extending through the dielectric member such that a single distal end of the gas injector is exposed within the processing chamber, a vacuum seal being provided between the gas injector and the dielectric window, the gas injector including a plurality of gas outlets in the single distal end supplying process gas at flow rates that are independently varied between at least some of the outlets into the processing chamber; and

an RF energy source which inductively couples RF energy through the dielectric member and into the chamber to energize the process gas into a plasma state to process the substrate.

11. (Original) The system of Claim 1, wherein the RF energy source comprises an RF antenna in the form of a planar or non-planar spiral coil and the gas injector injects the process gas toward a primary plasma generation zone in the chamber.

12. (Currently amended) The system of Claim 4 7, ~~wherein the single~~ further comprising a common gas supply ~~is split into multiple gas supply lines to feed~~ which supplies gas to the on-axis and off-axis gas outlets.

13. (Original) The system of Claim 1, wherein the ratio of gas flow through at least some of the gas outlets is independently varied using variable flow restriction devices.

14. (Original) The system of Claim 1, wherein the ratio of gas flow through at least some of the gas outlets is independently varied using a network of valves and throttling elements.

15. (Original) The system of Claim 1, wherein the gas injector is further provided with an electrically conducting shield which minimizes plasma ignition within gas passages located in the gas injector.

Claims 16-38 (Canceled).

39. (New) The system of Claim 1, wherein the on-axis outlet and the off-axis outlets are oriented at different angles relative to an exposed surface of the substrate.

40. (New) The system of Claim 10, wherein the plurality of gas outlets in the single distal end of the gas injector are oriented at different angles relative to an exposed surface of the substrate.

41. (New) A plasma processing system, comprising:

- a plasma processing chamber;
- a vacuum pump connected to the processing chamber;
- a substrate support on which a substrate is supported within the processing chamber;
- a dielectric member forming a wall of the processing chamber;
- a gas injector body extending through the dielectric member such that a distal end of the gas injector body is exposed within the processing chamber, the gas injector body including a plurality of gas outlets;
- means for supplying process gas at flow rates that are independently varied between at least some of the outlets into the processing chamber; and
- an RF energy source which inductively couples RF energy through the dielectric member and into the chamber to energize the process gas into a plasma state to process the substrate.

42. (New) A plasma processing system comprising:

a plasma processing chamber;

a vacuum pump connected to the processing chamber;

a substrate support on which a substrate is processed within the processing chamber;

a dielectric member forming a wall of the processing chamber;

a gas injector comprising an injector body including at least first and second gas inlets, at least first and second gas passages, and at least first and second gas outlets, the first gas passage being in fluid communication with the first inlet and first outlet, and the second gas passage being in fluid communication with the second inlet and second outlet, the first and second gas passages not being in fluid communication with each other;

flow controllers providing independently adjustable flow rates of gas through the first and second outlets; and

an RF energy source which inductively couples RF energy through the dielectric member and into the chamber to energize the process gas into a plasma state to process the substrate.